REMARKS

Claim 1 has been amended to include the limitation previously in claims 3 and 4. Claims 3, 4, 7, and 10 have been cancelled. The Examiner rejected all claims under 35 U.S.C. §103 as obvious over Tanaka et al. in view of Nakamigawa et al. Applicants respectfully traverse this rejection

The purpose of Tanaka et al. (U.S. Patent 5,854,727) is to provide a magnetic head that improves recording ability in a perpendicular magnetic recording system suitable for high recording density. The ratio rW/pL between the width pL in the traveling direction of the end face of the main magnetic pole and the track width t is defined by the relationship between the magnetic flux density Bs of the main magnetic pole and the distance δ from the end face of the main magnetic pole to the soft magnetic underlayer.

Tanaka et al. have the same goal of enhancing track density and narrowing the track as does the present invention. However, Tanaka et al. provide a magnetic head having a high recording ability by determining the relationship between the ratio tW/pL of the track width tW to the width pL in the traveling direction of the end face of the main magnetic pole, and the magnetic flux density Bs of the main magnetic pole (refer to col. 3, lines 34 to 42). Tanaka et al. disclose that the recording ability in a perpendicular recording system is enhanced by optimizing the configuration of the magnetic head. Therefore, it is different from the present invention, wherein the combination of a recording head with the perpendicular recording medium enables a high recording density to be achieved.

According to the present invention, in which the recording head is combined with the perpendicular recording medium, when the track width T_{ww} is less than 0.5 μm., it becomes possible to conduct recording due to the reduced dependency on the film thickness, even though saturation recording is conducted with the thin magnetic backing layer, which has been considered unfeasible in accordance with conventional ideas. This is because a new idea, regarding the effect of the magnetic field in the track end region of the main magnetic pole has been introduced.

Therefore, the present invention has been devised with the motivation to perform perpendicular recording with a thin backing layer, which has been considered unfeasible according to conventional ideas. In addition, when the track width T_{ww} is less than 0.5 μm., the film thickness of the magnetic backing layer can be made small by considering the effect of the magnetic field in the track end region of the main magnetic pole. This is a new technical discovery of the present invention. Only these motivations and technical discoveries have allowed the present inventors to come up with the idea of the present invention. No such motivation can be found in the references.

The invention of Tanaka et al. is intended for a recording head having a track width of 2 μm or less, and roughly around 1.0 μm. It does not meet the limitation of that T_{ww} is less than 0.5 μm. In addition, Tanaka et al. does not require taking into consideration the effect of the magnetic field in the track end region of the main magnetic pole, which has been first revealed in connection with the present invention. Thus, the effect of the track end of the main magnetic pole occurring in the present invention cannot be expected

Nakamigawa et al. provides a disk-shaped magnetic recording medium having significantly improved electromagnetic conversion characteristics, in particular high density recording characteristics.

A soft magnetic layer and a ferromagnetic layer formed by dispersing fine ferromagnetic hexagonal ferrite power into a binder are provided in this order on a nonmagnetic base. The ferromagnetic layer has a thickness of 0.5 μm or less and the dependence on the measurement direction of glossiness is within 5% when the glossiness is measured in an arbitrary place of the ferromagnetic layer.

The invention of Nakamigawa et al. is intended for a double layer perpendicular magnetic recording medium having a ferromagnetic layer and a soft magnetic layer. To this point, the recording medium of the present invention is the same as Nakamigawa et al. However, the invention of Nakamigawa et al. was achieved in consideration of the fact that it is difficult to measure the magnetic orientation when a double layer perpendicular magnetic recording medium

has a disk shape. Therefore, according to Nakamigawa et al., the magnetic orientation can be measured by a simple means in order to improve the density of the disk-shaped double layer perpendicular magnetic recording medium. Further, this enables the control of the orientation, which contributes to high densification. In other words, as described in detail in paragraphs [0015] to [0017], according to Nakamigawa et al, the fact that the surface roughness of the soft magnetic layer affects the effect of the soft magnetic layer is taken into account. The glossiness is used there as an index for surface roughness, and glossiness at an arbitrary place is kept constant regardless of the measurement direction so that not only the surface roughness becomes uniform but also the degree of orientation or flocculation of magnetic particles becomes uniform. Thus, a constant output can be obtained across the disk circumference.

The Examiner asserted that Nakamigawa et al. disclose a perpendicular magnetic recording medium having $T_{b1} = 0.5$ μm (page 2, paragraph [0007]) and $B_{S2} = 0.5$ T (5000G) (page 3, paragraph [0012]). However, the expression "0.5 μm or less" described in paragraph [0007] refers to the film thickness of a magnetic layer formed as a recording magnetic film, and it does not mean the film thickness of the soft magnetic underlayer. Thus, the Examiner's assertion "$T_{b1} = 0.5$ μm or less" is not correct. In the invention of Nakamigawa et al., importance is placed on the thickness of the strong magnetic layer comprising ferromagnetic hexagonal ferrite, but not on the thickness of the soft magnetic underlayer. Namely, the soft magnetic underlayer is formed so as to make the surface roughness uniform. By making the surface roughness of the soft magnetic underlayer uniform, the orientation or flocculation of the ferromagnetic layer formed thereon is made uniform, thereby enabling the magnetic properties of the ferromagnetic layer to be uniform. As described in paragraph [0018], the invention of Nakamigawa et al. utilizes the characteristic that "when a ferromagnetic layer is thin, the easy axis of magnetization is likely to face toward an in-plane perpendicular direction regardless of the orientation, because the hexagonal ferrite has a plate shape." Therefore, the thickness of the ferromagnetic layer is required to be 0.5 μm or less.

Nakamigawa et al. does not disclose that the film thickness T_{b1} of the magnetic backing layer and the saturation magnetic flux density B_{s2} that is defined by the relationship with the magnetic head and do not suggest even the necessity thereof. As mentioned above, the present

invention has been devised with the motivation to perform perpendicular recording with a thin backing layer, which has been considered unfeasible according to conventional ideas. In addition, when the track width T_{ww} is 0.5 μm or less, the film thickness of the magnetic backing layer can be made small by considering the effect of the magnetic field in the track end region of the main magnetic pole. This is a new technical discovery of the present invention. Only these motivations and technical discoveries have allowed the present inventors to come up with the presently claimed invention. Hence, if disregard is shown for the "track width T_{ww}" being less than 0.5 μm, which is a precondition that the effect of the present invention is expected to be obtained, the combination of the recording head of Tanaka et al. with the perpendicular recording medium of Nakamigawa et al. has no technical significance. If anything, based on the combination that does not allow the conditional expressions defined in the present invention to be satisfied, it is meaningless to calculate the expressions using only the numerical values.

In view of the above all remaining claims distinguish over the art and are in condition for allowance, prompt notice of which is respectfully solicited.

The Office is authorized to charge any underpayment or credit any overpayment to Kenyon & Kenyon Deposit Account No. 11-0600.

Respectfully submitted,

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